3. Reflection of Light by Different Surfaces

Mirror is an optically opaque material which forms images by the phenomenon of reflection. When light ray incident on the mirror it comes back in to the same medium this is known as reflection.

Mirrors are generally classified in to three types. They are 1.Plane mirror 2.Concave mirror 3.Convex mirror.

In the plane mirror, the image is virtual, appears lateral inversion. The concave mirror is also called convergent mirror. It forms virtual and real images. It also forms erected and inverted images. The convex mirror diverges the light rays. It forms virtual, diminished images.

In mirrors, the angle of incidence is equal to angle of reflection. According to Fermat's principle, light selects the path which takes the least time to travel. This was the principle behind why angle of incidence is equal to angle of reflection.

Concave mirror are used in making solar cookers. They are used in medical diagnosis by ENT specialists.

Formulae

1. Mirror formula-

   $$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

2. Magnification (m) = $-\frac{v}{u}$

   $$m = \frac{h_i}{h_0}$$

Problems

1) **An object 4 cm in size is placed at 25 cm in front of a concave mirror of focal length 15cm. At what distance from the mirror would a screen be placed in order to obtain a sharp image? Find the nature and size of the image?**

Sol: According to sign convention

Focal length (f) = -15cm

Object distance (u) = - 25cm

Object height (h_0) = +4cm

Image distance (v) =?

Image height h_i =?

Substitute the above values in the equation

$$\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$$

$$\frac{1}{-15}=\frac{1}{-25}+\frac{1}{v}$$

$$\frac{1}{25}-\frac{1}{15}=\frac{1}{v}$$

$$\frac{15-25}{25\times 15}=\frac{1}{v}$$

$$\frac{-15}{375}=\frac{1}{v}$$

V=–37.5cm

Magnification (m) = $\frac{h_i}{h_0}=-\frac{v}{u}$

$$\frac{h_i}{4} = -\frac{37.5}{25}$$

$$h_i = -4 \times \frac{37.5}{25}$$

$$h_i = -\frac{150}{25}$$

$$h_i = -6cm$$

So, the image is inverted and enlarged.

2) Find the distance of the image when an object is placed on the principal axis at a distance of 10cm in front of a concave mirror whose radius of curvature is 8 cm?

Sol. Given

Radius of curvature of the concave mirror R = 8cm

Focal length of the concave mirror f = $\frac{R}{2} = \frac{8}{2}$ = 4cm

Object distance (u) = 10cm

Image distance (v) =?

We know that

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$\frac{1}{4} = \frac{1}{10} + \frac{1}{v}$$

$$\frac{1}{v} = \frac{1}{4} - \frac{1}{10}$$

$$\frac{1}{v} = \frac{10-4}{40} = \frac{6}{40}$$

$v = \frac{40}{6} = 6.67$

∴ The image distance (v) = 6.67 cm

3) A convex mirror with a radius of curvature of 3m is used as rear view in an automobile. If a bus is located at 5m from the mirror find the position, nature and size of the image. (AS_1)

Sol: Radius of curvature R = 3m

Focal length f = $\frac{R}{2} = \frac{3}{2}$ = 1.5m

Object distance (u) = 5m

Image distance (v) =?

We know that

$$\frac{1}{f}=\frac{1}{u}+\frac{1}{v}$$

$$\frac{1}{f}=\frac{1}{-5}+\frac{1}{v}$$

$$\frac{1}{1.5}=\frac{1}{-5}+\frac{1}{v}$$

$$\frac{1}{v}=\frac{5+1.5}{1.5\times 5}=\frac{6.5}{7.5}$$

$$v=\frac{7.5}{6.5}=\frac{75}{65}=\frac{15}{13}=1.15$$

The image formed behind 1.15 cm of mirror image is virtual, erect and diminished.

4) An object is placed at a distance of 10cm from a convex mirror of focal length 15cm find the position and nature of the image. (As_9)

Sol: Given

Object distance (u) =10cm

Focal length (f) =15cm

Image distance (v) =?

We know that

$$\Rightarrow \frac{1}{f}=\frac{1}{u}+\frac{1}{v}$$

$$\frac{1}{15}=\frac{1}{-10}+\frac{1}{v}$$

$$\frac{1}{v}=\frac{1}{15}+\frac{1}{10}$$

$$\Rightarrow \frac{10+15}{15\times 10}=\frac{25}{150}=\frac{5}{30}$$

$$\frac{1}{v}=\frac{5}{30}$$

$$v=\frac{30}{5}=6cm$$

The image is virtual and seen in the mirror.

Magnification m= $-\frac{v}{u}=-\frac{6}{-10}=0.6$

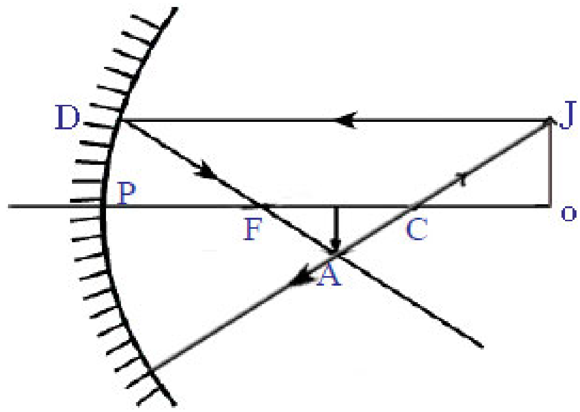
So the image is erect and diminished.

1 Mark Questions

1. What do you know about the terms given below related to spherical mirrors?

a. Pole **b.** Centre of curvature **c.** Focus **d.** Radius of curvature **e.** Focal length

f. Principal axis **g.** Object distance **h.** Image distance **i.** Magnification



a. Pole (p): The geometrical centre of the mirror is called pole of the mirror.

b. Centre of curvature (C): the centre of curvature of a spherical mirror is centre of sphere of which the mirror is a part.

c. Focus (F): It is a point on its principal axis to which all the incident rays which are parallel and close to axis converge.

d. Radius of curvature (R): The distance between pole and centre of curvature is called radius of curvature of the mirror.

e. Focal length (f): The distance between the pole and image of the mirror is called focal length of the mirror.

f. Principal axis: The horizontal line which passes through the centre of curvature and pole is called central axis or principal axis.

g. Object distance (U): The distance between the pole of the mirror and object is known as object distance.

h. Image distance (V): The distance between the pole of the mirror and image is known as image distance.

i. Magnification: The ratio of height of image to the height of the object is known as linear magnification.

Magnification m=$\frac{h_i}{h_o}$

2. When does a concave mirror form virtual image?

A) A concave mirror forms virtual image when the object is placed between pole and focal point.

3. What are the values of radius of curvature and focal length of a plane mirror?

A) Both the radius of curvature and focal length of a plane mirror are infinity.

4. What is the relation between radius of curvature and focal length of a concave mirror?

A) The focal point is the midpoint of centre of curvature and pole. So, focal length is half of radius of curvature.

5. How do you find magnification produced by a spherical mirror?

A) There are two ways of finding the magnification

a) The ratio of size of the image to object distance [m=$\frac{h_i}{h_o}$]

b) The ratio of image distance to object distance [$m = \frac{v}{u}$]

6. What does the sign of magnification indicates?

A) **+Ve magnification**: The image is erect, virtual.

- Ve Magnification: The image is inverted real.

7. What happens to image when an object is moved towards a concave mirror from infinity?

A) The image moves away from mirror staring from focal point to infinity.

8. Can a convex mirror burn a paper? If not? Why?

A) We cannot burn a paper by using a convex mirror, because the rays coming parallel to principal axis after reflection diverge from the mirror.

9. Which mirror has wider field view?

A) A convex mirror has wider file view.

10. Why does our image appear thin or bulged?

A) Due to converging or diverging of height rays from the mirror.

11. Can we focus sunlight at a point using a mirror instead of magnifying glass?

A) Yes, by using concave mirror we can focus sun light at a point.

12. Why is angle of incidence is equal to angle of reflection when a light ray reflected from a surface?

A) Because light selects the path that takes least time to cover a distance.

13. Are angle of reflection and angle of incidence equal for curved surface?

A) Yes, it is equal for curved surfaces like spherical mirrors.

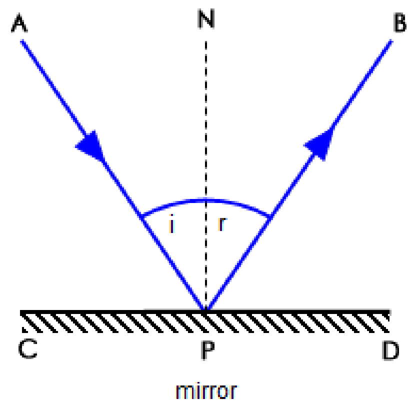
2 Marks Questions

1. State the laws of reflection of light? (AS_1)

A) Laws of reflection:

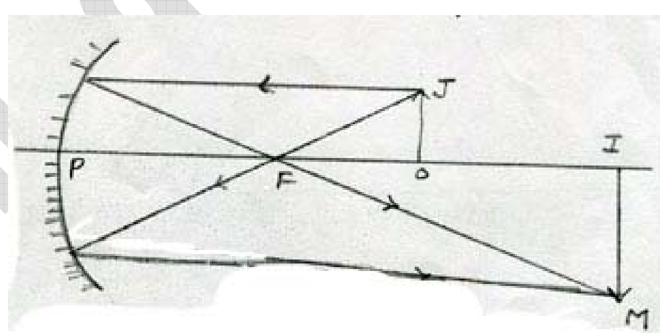
1. **First law:** the angle of incidence is equal to the angle of reflection.

2. Second law: The incident ray, the normal and the reflected ray lie in the same plane.



2. Where will the image form when we place an object, on the principal axis of a concave mirror at a point between focus and centre of curvature (As_1)

A)



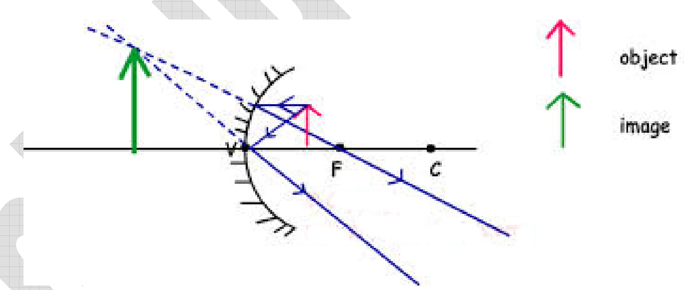
When an object is placed between focus and centre of curvature on the principal axis of a concave mirror, a real inverted image is formed beyond the centre of curvature.

3. State the differences between convex and concave mirrors. (As_1)

Convex Mirror	Concave Mirror
1. If outer side of a spherical mirror is reflecting, it is convex.	**1.** If inner side of spherical mirror is reflecting it is concave.
2. It always forms virtual erect and diminished image irrespective of position of object.	2. It forms real inverted images except when the object is between pole and focus.
3. It is used as rear view mirror in auto mobiles and optical instruments.	3.It is used in search lights, automobile head lights, reflecting telescopes etc.

4. How do you get a virtual image using a concave mirror?

A) When an object is kept between pole and focus of a concave mirror virtual image is formed behind the mirror.



5. Write the rules of sign convention?

A) 1. All distances should be measured from the pole.

2. The distances measured in the direction or incident light, to be taken positive and those measured in the direction opposite to incident light to be taken negative.

3. Height of object (H_0) and height of image (H_i) are positive if measured upwards from the axis and negative if measured downwards.

6. The magnification produce by the plane mirror is +1.what does this mean?

1. Magnification = $\frac{Height\ of\ the\ image\ (H_i)}{Height\ of\ the\ object(\ H_o)}$

Given $\frac{H_i}{H_o} = 1$

2. If the magnification of the image is +1, it indicates that the size of the image is equal to the size of the object.

3. The +ve sign of the magnification of the plane mirror indicates that the image is erect.

7. Imagine that spherical mirrors were not known to human beings. Guess the consequences? (AS_2)

A) If spherical mirrors were not known, the below said developments may not be possible

1. Safe driving in automobile will not be possible.

2. Automobile head lights, torch light, search lights cannot give bright lighting.

3. Constructions of reflecting telescopes would not be possible.

4. Dentists may not have proper diagnosis of teeth.

8. By observing steel vessels and different images in them, Surya a third class student asked some questions his elder sister Vidya. What may be those questions?

A) After observing the images, formed on steel vessels, surya may ask the following questions to his elder sister Vidya, they may be-

1) Why the image is not clearly visible?

2) Why the image is blurred?

3) Why the image is not as clear as in mirror?

4) Why the image seems to be small sometimes?

9) How will our image be in concave and convex mirror?

Concave mirror:

1) In concave mirrors our image is thin and enlarged.

2) As we move away from the mirror, the image will be diminished and become pointed at the-

Convex mirror:

1) In convex mirror, our image is bulged and size of image is diminished.

2) As we move away from the mirror, the image is further diminished.

10) How do you appreciate the use of reflection of light by a concave mirror in making of antenna dishes?

A) I appreciate the working process of TV antenna dishes. It contains the concave surface to receive the signals from the distinct communication satellites. The concave (parabolic) shape of a dish antenna helps to reflect the signal to the focal point of the dish. A device known as feed horn is mounted at the focal point which gathers the signals and sends them to processing unit.

11) Have you ever observed the image of the sky in rain water pools on earth? Explain the reflection of light in this context?

A) The surface of rain water pool acts as a plane mirror. When light rays incident on the surface of water pool, we can observe a virtual image of the sky. The incident ray undergoes irregular reflections from the surfaces. Hence we cannot see the image of the sky.

12) Why do we prefer a convex mirror as a rear-view mirror in the vehicle?

We use convex mirror as a rear view mirror in the vehicles because

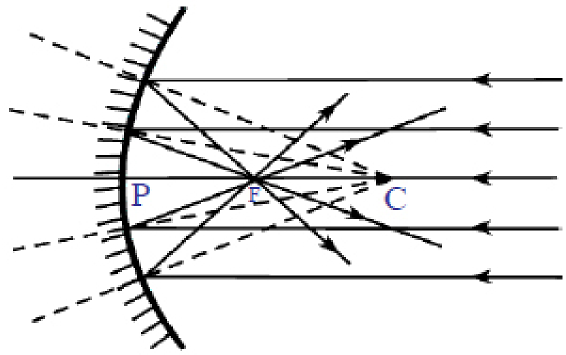
1) Convex mirror always forms virtual, erect and diminished images irrespective of distance of the object.

2) A convex mirror enables a driver to view large area of the traffic behind him.

3) Convex mirror forms very small image than the object. Due to this reason convex mirrors are used as rear view mirrors in the vehicles.

4 Mark Questions

1) How do you find the focal length of a concave mirror?



A) Hold a concave mirror such that sunlight falls on it. Take a small paper and slowly move it in front of the mirror and find out the point where you get the smallest and brightest spot, which will be the image of the sun.

The rays coming from the sun parallel to the principal axis of the concave mirror converge to a point. This point is called focus or focal point (F) of the concave mirror. Measure the distance of this spot from the pole of the mirror. This distance (PF) is the focal length (f) of the mirror. The Radius of curvature (R) will be twice this distance (R=2f).

2 Distinguish between real and virtual images? (AS_1)

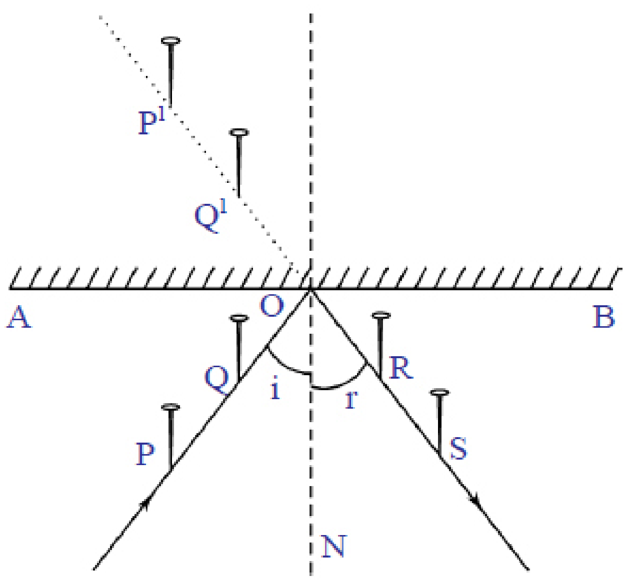
Real image	Virtual image
1. Real image is formed due to actual intersection of the reflected ray. 2 Inverted images are formed 3. Image can be obtained on the screen. 4. Real images can be diminished magnified or same size of the object	1. Virtual image is formed by the extending the diverging light rays backwards. 2. Erect images are formed. 3. Image cannot be obtained on the screen. 4. Virtual images are always diminished

depending on the object distance. 5. Real images can be seen directly on the screen without looking into the mirror.	irrespective of position of the object. 5. Virtual images are visible only in the mirror.

3. How do you verify the 1st law of reflection of light with an experiment?

A. Aim: verification of 1st law of reflection.

Required material: Mirror strip, drawing board, plane mirror, pins, clamps, scale and pencil.



Procedure: Take a drawing board and fix a white paper on it with the help of clamps. Draw a straight line AB at the centre of the paper and also a normal (on) to AB at the point 'O'. Draw a straight line PQ making certain angle (i) with on as shown in figure. Fix two pins at the point P and Q on the paper vertically observe the image P' of the pin P and Q' of the pin Q in the mirror kept along the line AB. Fix two more pins R and S such that they are in the same line as that of P' and Q' . Join R, S and O as shown in figure.

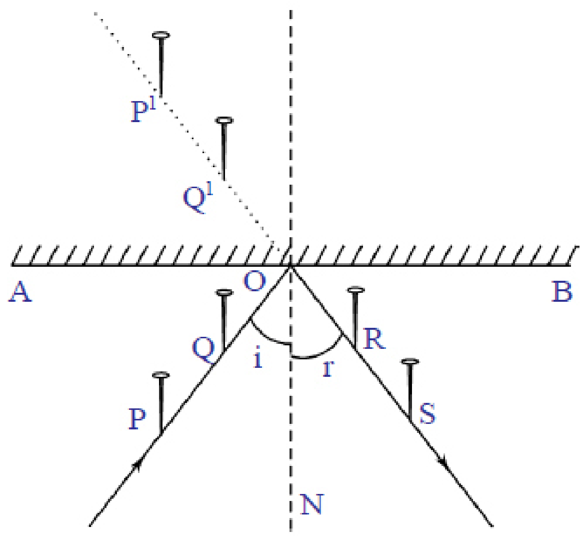
Observations: The angle between RS and ON is almost same as that of PQ and ON i.e., the angle of incidence= angle of reflection repeats the experiment with different angles of incidences and measures the corresponding angles of reflection.

Conclusion: In all observations the angle of incidence is equal to the angle of reflection.

4. How do you verify the 2nd Law of reflection of light with an experiment?

A. Aim: Verification of 2nd law of reflection.

Required material: mirror strip, drawing board, plane mirror, pins, clamps, scale and pencil.



Procedure:

1. Take a drawing board and fix the plane mirror on it with the help of clamps.

2. Draw straight line AB along the mirror and also a normal (ON) to AB at the point 'O'.

3. Draw a straight line PQ making certain angle (i) with on as shown.

The incident ray is the ray which is passing through the points ‘P’ and ‘Q’ touching the paper. The reflected ray is the ray which is passing through the points ‘R’ and ‘S’ touch the same paper and ‘ON’ is the normal to the mirror point ‘O’ .

Observation: The incident ray and reflected ray are in the plane parallel to the plane of the paper. Repeat the experiment with different angles of incidence.

Conclusion: In all observations incident ray and reflected ray are present in the same plane hence 2^{nd} law of reflections is proved.

5. What do you infer from the experiment which you did with concave mirrors and measure the distance of object and distance of image?

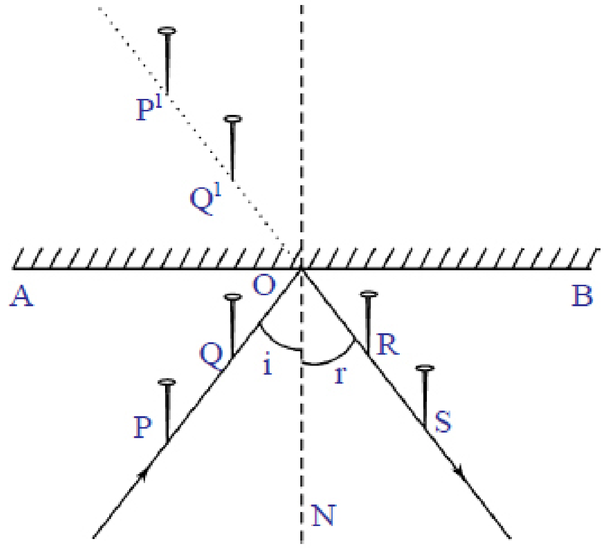
A. The observations from the experiments are

1. When an object is infinity distance the image is formed at the focus.

2. When an object is placed beyond the centre of curvature, the image is formed between the focus and centre of curvature.

6. Find the plane of the reflection experimentally for the incident ray which passes through the heads of the pins pierced in front of the mirror? (As_3)

A. The plane in which the incident ray, reflected ray and normal will lie is the plane of reflection.



1. Take a drawing board and fix a white paper on it with the help of clamps.

2. Draw a straight line AB at the centre of the paper and also a normal (ON) to AB at the point 'O'.

3. Draw a straight line PQ making certain angle with ON.

4. Fix two pins at the points P and Q on the paper vertically.

5. Observe the image p' of the pin P and Q' of the pin Q, in the mirror kept along the line AB.

6. Fix two more pins R and S such that they are in the same line as that of P' and Q'.

7. Join R, S and O.

8. Assume that the heads of all pins pierced at points P, Q, R and S are in the same height.

9. If the incident ray is the ray which is passing through the heads of pins those are localized at P and Q and reflected rays is the ray which is passing through the heads of pins those are located at points R and S, then the normal lies along the plane of PQRS.

10. Then the plane along PQRS is known as plane of reflection.

7. Think about the objects which act as concave or convex mirrors in your surroundings. Make a table and display in your class room?

Convex mirror	Concave mirror
1. Vehicle mirrors.	1. Head light of motorcycle.
2. Globe.	2. Inner surface of glasses
3. Calling Bell	3. Sink inwards
4. Surface of the steel flask.	4. Spoon bulged inwards.
5. Surface the pens.	5.Inner surface of cooking vessel
6. Spoon bulged out wards.	

8. Collect information about the history of spherical mirrors in human civilization. Display it in your class room?

A. The idea of mirror came into existence long back when people saw their images in water on polluted surfaces etc.

The earliest manufactured mirrors were pieces of polished stone such as obsidian a naturally occurring volcanic glass.

The Romans also developed a technique for creating crude mirrors by coating blown glass with molten lead.

The first modern silver-glass mirror was created by Justus von Liebig, a German chemist in 1835.

The invention of glass blowing method during the 14^{th} century led to the discovery of spherical mirrors, which increased the popularity of glass mirrors. By the end of 18^{th} century, decorative mirrors were widely used.

New cheaper techniques of mirror production in the 19^{th} century led to a great proliferation of their use.

9) Draw and explain the process of formation of image with a pin hole camera.

A) Process of formation of image with a pin hole camera.

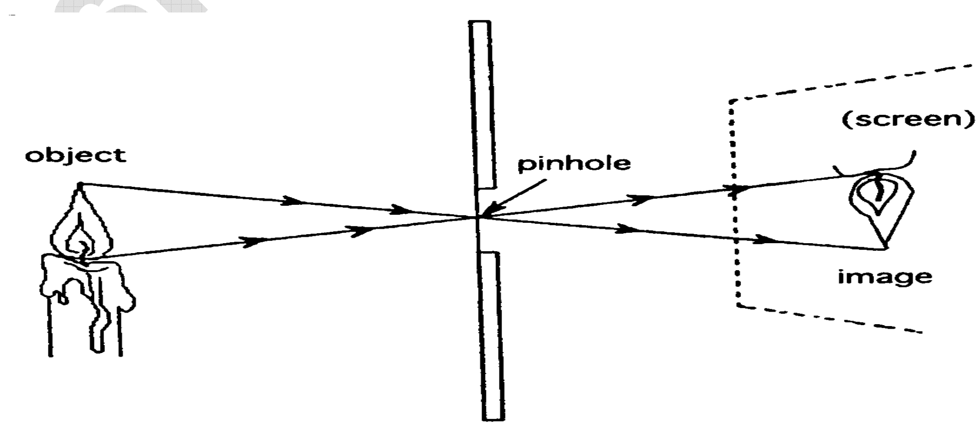
1) The light from candle travels straight in all directions from each point of the flame of the candle.

2) But only the light coming in some particular directions can enter into the camera through its pin hole.

3) Light which comes from the point at the top of the flame goes straight towards the bottom of the screen and light which comes from the [point at the bottom of the flame goes straight towards the top of the screen as shown in the figure.

4) The other rays are blocked by the black sheet.

5) This leads to the formation of an inverted image.



10. Make a solar header / cooker and explain in process of making?

A. Principle: A concave mirror focuses parallel sun ray at the focal point of the mirror and produces heat energy at that point.

Process: Make a wooden /iron frame in the shape of TV dish. Cut acrylic mirror sheets into 8 or 12 pieces in the shape of isosceles triangles with a height equal to the radius of your dish antenna. The bases of the 8 or 12 triangles together make the circumference of the dish. Stick the triangle mirrors to the dish.

Arrange it so that concave part faces sun. Find its focal point and place a vessel at that point. It will get heated. One can even cook rice in that vessel.

11. To form the image on the object itself, how should we plane the object in front of a concave mirror? Explain with a ray diagram?

A. To form the image on the object itself, the object should be kept at centre of curvature a concave mirror.

Explanation: 1. AB has been placed at the centre of curvature C on the concave mirror.

2. A ray of light AD which is parallel to the principal axis passes through the focus F after reflection.

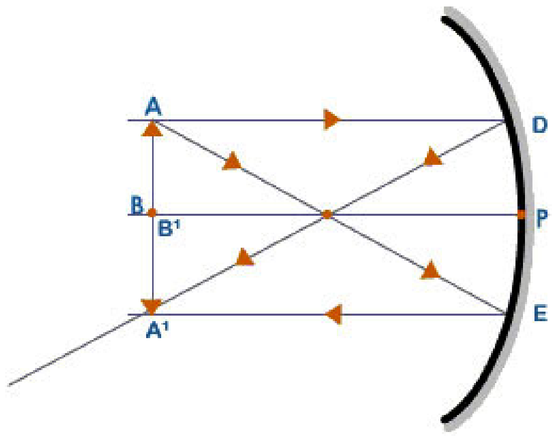
3. The second ray of light that we usually use is the one passing through the ‘C’ but in this case the object itself placed at the centre of curvature.

4. A ray of light passing through the focus of the concave mirror becomes parallel to the principal axis ray AE passing through the focus F.

5. It strikes the mirror at the point E and gets reflected in the direction of EA. Parallel to the principal axis.

6. the reflected ray DA’ and EA’ meet at a point A of A’. So the real image formed at point A of the object. To get the complete image, we draw A’ B’ perpendicular to the principal axis.

8. This A’ B’ is the real image of the object AB.



12. How do you appreciate the role of spherical mirrors in our daily life? (As_6)

A. Spherical mirrors (concave and convex mirrors) are very useful to our life. They are-

1. Concave mirrors are used by dentists to see the large images of the teeth of patient.

2. Spherical mirrors are used in telescopes.

3. Concave mirrors are used as reflectors in torches and vehicle head lights.

4. Concave mirrors are used in solar furnaces.

5. Convex mirrors are used as rear view mirrors in vehicles.

13. Discuss the merits and demerits of using mirrors in building elevation?

A. Merits:

1. Mirrors can be cut into different shapes or sizes.

2. Mirrors do not rust.

3. Mirrors do not let water passing through them.

Demerits:

Elevation of buildings with mirrors is not suggested able because these are.

1. These mirrors reflect sun rays at day time and reflect lighting from nearby electrical bulbs at light time, which causes confusion and people who are running on the nearby roads lead to accidents.

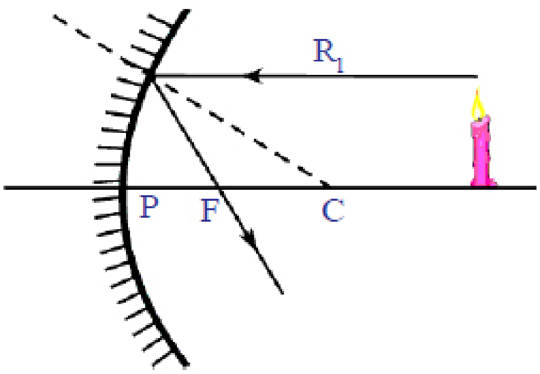
2. Birds like sparrows; crow will get confusion while flying on roads.

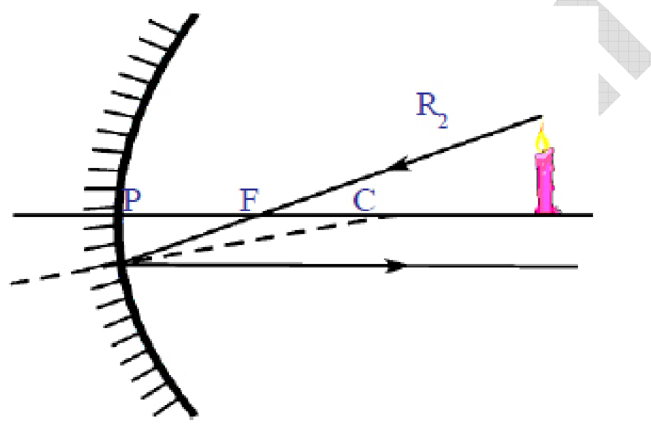
3. They are also not safe enough to the buildings, which causes easy access thieves.

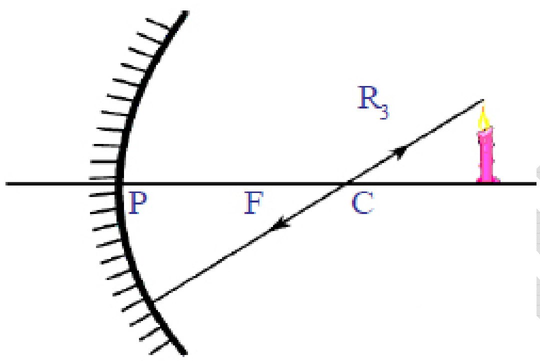
4. Glass elevation is not environmental friendly, becomes natural air does not enter into the building.

5 Marks Diagrams

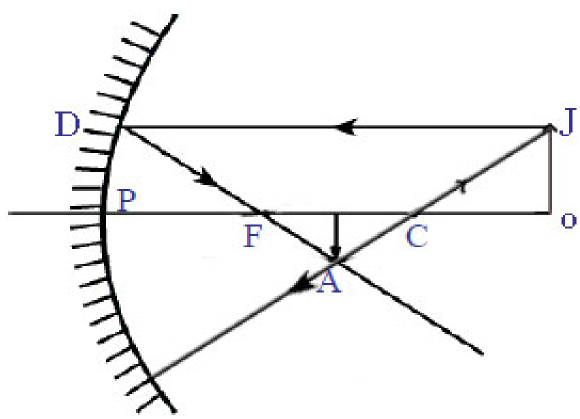
1. **Draw suitable rays by which we can guess the position of the image formed by a concave mirror.**







2. Show the formation of image with a ray diagram when an object is placed on the principal axis of a concave mirror away from the centre of curvature.



Fill in the Blanks (Half Mark)

1. Light travels in a ---------------- line.

A. Straight

2. The centre of sphere to which a spherical mirror belongs, is called ----------------.

A. Centre of curvature

3. The geometric centre of the mirror is -------**.**

A. Pole

4. The rays which are parallel to the principal axis of a concave mirror on reflection, meet at-

A. Focus

5. The line which passes through the centre of curvature and pole is -------.

A. Principal axis

6. The distance between pole and center of curvature-----------.

A. Radius of curvature

7. The distance between pole and focus ----------------.

A. Focal length

8. The relation between focal length and radius of curvature is given by-----------.

A. f=2r or r= $\frac{f}{2}$

9. Light selects the least time path to travel between two points. This principle was stated by-

A. Pierre de Fermat

10. The equation of the mirror is --------.

A. $\frac{1}{F}=\frac{1}{u}+\frac{1}{v}$

11. The relation between the angle of incidence and angle of reflection is given by ---------.

A. i=r

12. In the pin hole camera if hole is big we get------image.

A. Blurred

13. Concave mirror focuses parallel sun rays at the -----------of the mirror.

A. Focal point

14. The image that can be formed on the screen is called ------.

A. Real image

15. ------------ Cannot be form on screen.

A. Virtual images

16. --------- Image is formed in pin whole camera.

A. Real and inverted

17. Shaving mirrors are ------------.

A. Concave mirrors

18. Dish antenna is ------ shape to observe the signals.

A. Concave

19. In shops security system -----------mirrors are used.

A. Convex

20. -------------- is called converging mirror.

A. Concave mirror

21. ----------is called diverging mirror.

A. Convex mirror

Multiple Choice Questions

1. If an object is placed at 'c' on the principle axis in front of a concave mirror, the position of the image is _________. **[c]**

A) At infinity **B)** between F and C **C)** At C **D)** beyond C

2. We get a diminished image with a concave mirror when the object is placed ___. [d]

A) At F **B)** between the pole and F **C)** At c **D) beyond C**

3. We get a virtual image in a concave mirror when the object is placed______. **[b]**

A) At F **B)** between the pole and F **C)** At C **D)** beyond C

4. Magnification m=_______. **[a and d]**

A) $\frac{v}{u}$ **B)** $\frac{u}{v}$ **C)** $\frac{h_0}{h_i}$ **D)** $\frac{h_i}{h_o}$

5. A ray which seems to be travelling through the focus of a convex mirror passes_____ after reflection. **[a]**

A) parallel to the axis **B)** along with the same path in opposite direction

C) Through F **D)** through C

6. The angle of reflection is equal to the angle of incidence **[a]**

A) Always **B)** Sometimes **C)** Under special condition **D)** Never

7. _____ Mirrors are used in solar cookers. **[c]**

A) Convex **B)** Double Convex

C) Parabolic **D)** Spherical

8. The angle of incidence between the plane of a mirror and light ray is 45^0. The angle of reflection is _________. **[b]**

A) 30^0 **B)** 45^0

C) 60^0 **D)** 90^0

9. The mirror which can form a magnified image of an object is ______. **[c]**

A) Convex mirror **B)** Plane mirror

C) Concave **D)** Both convex and concave mirrors

10. Magnification produced by a convex mirror is always ____. **[c]**

A) More than 1 **B)** Less than 1

C) Equal to 1 **D)** All of the above

11. The focal length of a spherical mirror of radius of curvature 30cm is ______. **[b]**

A) 10cm **B)** 15cm

C) 20cm **D)** 30cm

12. The image of an object formed by a plane mirror is ____. **[a]**

A) Virtual **B)** Real **C)** Diminished **D)** Upside-down

13. The mirror used by ENT specialists is _. **[b]**

A) Plane **B)** Concave

C) Convex **D)** None of these

14. The scientist who burned ships using mirrors is __. **[a]**

A) Archimedes **B)** Pierced de format

C) Snell **D)** Faun hoofer

15. The centre of mirror is called _____ **[b]**

A) Centre of curvature **B)** Vertex

C) Radius of curvature **D)** Focus

Matching

1. Group A

1. Concave mirror [**d**] a. Virtual image.

2. Convex mirror [**a**] b. Divergent mirror

3. Plane mirror [**e**] c. Convergent mirror

4. Security mirror [**b**] d. Real image

5. Head light reflections [**c**] e. laterally inverted

f. Focal length

2. Group B

1. Rare view mirror used in vehicles [**d**] a. >1

2. Mirror used by dentists [**c**] b. <1

3. Mirror used at homes [**f**] c. Concave mirror

4. The magnification of convex Mirrors always [**b**] d. convex mirror

5. Magnification [**e**] e. $\frac{v}{u}$

f. plane mirror

3. Group C

1. Plane	[**d**]	a. rear view in automobiles
2. Convex	[**a**]	b. barber shop
3. Concave	[**b**]	c. solar cooker
4. Parabolic	[**c**]	d. households as toilet mirror
5. Centre of the spherical Mirror	[**f**]	f. pole